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158

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THE ORGANIZATION OF AIRWAYS.

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An aircraft freed from all contact with the ground during most of the period of its operation, is nevertheless dependent on the provision of proper ground organization. Flying may and can get along without a subsidy, but it never can get along without airways provided with landing fields, lights, weather forecast service, radio stations for the broadcasting of storm warnings and other information, and other accessories necessary for safe and regular operation. The organization of such airways is logically a governmental responsibility, and is one which no government not desirous of cutting off the newest means of transportation can afford to ignore.

The provision of landing fields scattered over the country for the benefit of civil or military pilots who may arrive from any direction constitutes the first step toward making commercial flying possible. The laying out of definite airways, along which it is expected that regular services are to be operated, is the second.

The term airway may connote many things, ranging from a few landing fields strung out along the route to be covered by the aircraft, fields without even the facilities for the furnishing of fuel or mechanical assistance to the stranded pilot, to an elaborately planned route with completely-equipped landing fields at every few miles and with equipment making it possible for the course to be covered at night or in fog as well as by day.

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* Taken from Christian Science Monitor, October 2, 1922.

The first and most essential elements are obviously the fields themselves, the number and nature of which will depend largely on the purpose for which the airway is being planned and the types of aircraft by which it will be used. The French Air Ministry groups airplane fields in five classes, but three divisions are ordinarily sufficient - major terminals, landing fields and emergency fields. The great terminals or airports should be equipped with shops capable of making any ordinary airplane repairs or overhauling engines, and should have full provision for the quick and convenient handling of passengers and express. Since the terminal will ordinarily be at the junction of two or more routes running in different directions, and since there is always a possibility of congestion of arriving and departing airplanes, a traffic control system, with a dispatcher mounted in a tower to signal to pilots when it is safe for them to take off or to land, should be included in the plans.

The landing fields, which will be placed at intermediate stations on commercial air routes or in the neighborhood of cities not served by regular lines, but where numbers of airplanes are nevertheless likely to come and go, should be able to furnish fuel and oil and hangar accommodation, and trained men should always be within reach to assist a pilot in making minor repairs and replacements. The emergency fields, which will not be used except in case of trouble, should be located not more than 20 miles apart, and a 10-mile interval is preferable to any wider one. Emergency fields need not have any equipment, although it is desirable that

gasoline should be available and that one or two people familiar with airplanes should be within easy reach, and they need not be set aside for the exclusive use of airplanes. Their usefulness i not seriously interfered with by the planting of any crop which can be grown on smooth ground and which does not grow to a height of more than eighteen inches.

An airway for night flying should be lighted to such an extent that the fields can be easily located in case of need. This does not require an elaborate or expensive system, as the airplane's own lights mounted on the lower wing suffice for the actual making of the landing. It is enough to have each emergency field marked by a dozen lights of characteristic color or grouping marking the limits of the space within which it is safe to land and to provide every 30 or 40 miles an "aerial lighthouse." These lighthouses may resemble a marine lighthouse in form, casting their light downward to illuminate the surroundings and particularly a characteristic marker placed on the ground to identify the light, or they may consist simply of powerful searchlights throwing their beams upward. The identifying characteristic in the case of the searchlight corresponding to the color and flash interval of a marine light may be furnished by flashing the light on and off at regular intervals or by sweeping it back and forth across the sky in accordance with a regular sequence. The true "lighthouse" has the advantage of showing objects on the ground and there is no danger of the pilot's being blinded by its rays, as he may be by the swinging beam of the searchlight if it str[illegible]

him squarely in the eyes, but the searchlight can be seen from a much greater distance than the more diffused ground light, especially in clouds or fog.

Fields where frequent landings are to be made at night, particularly if the airplanes coming in there include small and fast airplanes landing at high speed and incapable of carrying proper lights for the purpose, should also be equipped with flood lights mounted on the roofs of buildings and giving a thorough and even illumination of the field proper. These are switched on only when an arriving pilot gives the signal that he is about to land. With good flood lighting of the field landing is as easy by night as by day. Every field should also have a system of lights which can be used, by switching some on and others off to indicate the wind direction.

It is much more difficult to find a field and to land there safely in fog than at night. Devices for guiding aircraft to their destination in thick fog are still experimental, but the development of direction-finding radio has progressed to a point where every airway should be equipped with it. The Loth system of laying along the route a cable from which electric impulses are radiated for the purpose of informing the pilot, who receives record of the impulses through his receiving apparatus, whether or not he is on the course, should also be brought into use near the fields where landings are regularly to be made, as directional radio is not accurate enough to serve as a guide when very close to one's destination.

To protect the pilot against storm hazards he must be informe at all times of the nature of the weather ahead of him. Frequent and regular reports must be obtained from observers along the route and for a distance of 50 miles or more on each side. These reports are posted at all the landing fields along the route and also broadcast by radio for the benefit of pilots whose airplanes are equipped with receiving apparatus. Most large commercial airplanes are now so equipped and all should be. The ordinary observations now made at weather bureau stations do not suffice for the purposes of the air pilot, and the operation of an airway requires a decided extension of weather bureau activities. In addition to containing storm warnings, the aeronautical report must give particular attention to the height and density of the first layer of clouds and to the amount of atmospheric haze interfering with visibility. It is also desirable that small balloons be released at short intervals at some, at least, of the observing stations, in order that direction and speed of the wind at high altitudes may be estimated from the motion of the balloon.

The cost of laying out an airway is not great, especially as municipalities are generally glad to donate the land for fields and it is only necessary for the central authority to provide the organization proper. It is conceivable that a private company might be able to provide its own fields and lighting and radio service and still make both ends meet, and at least one of the major air transport enterprises now being promoted in the United States is to undertake that burden. But it is manifestly unfair that it

should be required to do so. An airway cannot possibly be a monopoly, and landing fields must be open to use by all parties flying over them. It would be unjust in the extreme to saddle the first company undertaking to operate over a route with the initial expense for an organization from which all rivals entering the field would profit to as great an extent as the parties who assumed all the original responsibility and risk. Only the government should be required to meet expenses designed to serve the common good.